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ABSTRACT

Current research on information processing suggests that short term memory plays a central role in the sorting and manipulation of text information during reading. Because an entire text cannot be processed simultaneously, successive "chunks" or units of information enter the short term memory where they are compared to the reader's previous experience. During the first processing cycle, one of the propositions is designated as the main idea. In succeeding cycles, information is added onto the short term memory buffer in the form of alterations to or additional support for the main idea. The coherent structure formed from these chunks of information is stored in the long term memory, and constitutes reading comprehension. As the ability to recognize key propositions is a key task in text comprehension, training in text organization skills may lead to a more directed use of the short term memory buffer and therefore to improved comprehension. (MM)

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The Role of Short-term Memory
In the Comprehension
of Written Text

by
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Neurological Issues in
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To comprehend, a reader must understand the ideas expressed by combinations of word meanings (represented as phrases or chunks) while, at the same time, organizing those chunks into ideas which match the accumulating experience of both the text premise and the readers' schemata or background experience. The organization of those combinations appears essential to successful comprehension. Poor readers appear to read text in a word-by-word fashion (Golinkoff, 1976) seemingly oblivious as to how these combinations can or should be linked. Cromer (1970) indicates that at least one type of poor reader, the difference reader, can be helped by learning text organization skills.

It would appear then that the ability to link what Fletcher (1981) called 'propositions' in text is essential to linking up individual words into larger units of meaning. The role that the short-term memory plays in forming interrelationships between the emerging text premise and individual word meanings has long been implicated (Davis, 1971; Mackworth, 1972; Torgesen, 1978). Haber (1969) and Lindsay & Norman (1972) provide a model for understanding information processing during visual perception. They offer a three-subsystem model which has been refined and adapted to reading (Geyer, 1970; Gough, 1972; Mackworth, 1972; LaBerge & Samuels, 1974; West, 1975).

According to this model, a visual information store holds a visual image as a whole for 250 milliseconds allowing for an analysis of features where incoming information is matched with past information. The image and the memory will fade without rehearsal or practice which allows the movement of the information into short-term memory. Organization of the new information and its integration with past experience allows the critical link to long-term memory where relationships and associations are stored.

Keir (in Tarnopol & Tarnopol, 1971) believes that such a model can have useful application to auditory processing as well.

He hypothesizes that three separate auditory storage systems - a short-term auditory storage and a short-term and a long-term memory operate to allow an auditory signal to be understood and incorporated into one's permanent memory storage.

According to the model, arriving auditory stimuli enter the short-term auditory storage. The duration of the short-term auditory storage, 1-1.5 seconds, allows the maintenance of an accurate sensory image for a long enough period of time to permit a decision regarding the relevancy of that information.

The short-term auditory storage, then, acts as a filter to monitor all incoming sensory information, rejecting the irrelevant and holding the relevant. Selected information is then placed in a short-term memory buffer by a process of subvocal rehearsal. Subvocal rehearsal is believed to be essential for information to be transformed and placed into the short-term memory, and, if interfered with, the information can be lost from the system.

At this point, then, the information in short-term memory is no longer a complete image of what arrived at the ear, but rather is an interpretation of the relevant part of that information. This coding, therefore, consists not of the actual words received, but of an interpretation of the essential information which has been rehearsed subvocally and then placed in the short-term buffer. The short-term memory is then a temporary holding reservoir for incoming coded information. It is believed to have a limited capacity of seven discrete units of information held at any one time (Miller, 1956).

The role of the short-term memory is to accumulate and hold arriving units of auditory information long enough for them to build up into a pattern that can be recognized by the listener. As the auditory information arrives and accumulates in the short-term memory, it is continually being thought about and compared with information in the reservoir of past experiences.

Understanding occurs when the constant scanning produces an experience from the past that matches, or is closely associated

with the current one. That recognition of meaning - the sudden equating of the gradually built up and often incomplete pattern with the past experience is the process of auditory closure or gestalt.

The auditory gestalt is the last process and must function successfully for the final recoding of information to take place. The final recoding allows the transfer of information from short-term memory into long-term memory freeing the short-term memory system for the arrival of new incoming information.

The preceding model will now be applied to the comprehension of text during reading. According to models developed by Miller, Kintch & Van Dijk (1980), and tested by Fletcher (1981), text is processed by the skilled reader through the breaking of the text into 'chunks' or 'propositions'. Each proposition is perceived, held in the short-term buffer, rehearsed and then collapsed into an accumulated meaning held in long-term memory.

Text is therefore processed in a cyclical fashion as the entire text cannot be held in short-term memory simultaneously. It, instead, must be broken into manageable units - the 'propositions' or 'chunks'.

The nature of the 'propositions' selected is important. Those that are coherent with the new propositions will provide easy access to the appropriate meaning in short-term memory. An ordered list of propositions is created where the order is a function of the relational terms in surface text. The proposition list is then processed in groups of several propositions at a time. Groups are determined in part by phrase or sentence boundary or sentence continuity.

During each processing cycle, or new perception, current propositions are placed in short-term memory where they are organized into a coherent whole based on shared meaning.

Propositions are stored in long-term memory on the basis of coherent meaning. These propositions are then reprocessed along with propositions that enter during the next cycle. If the propositions are coherent with the new information, the accumulated meaning is stored in long-term memory. Otherwise, coherence is maintained by searching the long-term memory for a bridging proposition or by drawing a bridging inference.

During the first processing cycle, one of the propositions (sentences) must be designated as superordinate (the main idea). In succeeding cycles, information is added onto in the short-term memory buffer, in the form of alterations to the main idea, or addition of details that support the main ideas.

After each cycle, the coherent structure is stored in long-term memory using the propositions held over from previous cycles as points of contact with information already stored. This cyclical process allows a building up of a text base of coherence that forms what we refer to as comprehension.

Selection of the superordinate proposition or main idea may be linked to the readers' own schemata or background knowledge. Steffensen, Joag-Dev, Anderson (1979) found that the schemata embodying background knowledge about the content of discourse (and I quote) "exert a profound influence on how well the discourse will be comprehended, learned and remembered" (p. 19).

Weaver (1979) found that training average and above average third graders in sentence (text) organization skills had a positive effect on their comprehension. In the sentence anagram test, 26 anagrams were included, ranging in length from 5-15 words with 4-5-word and 4-6-word sentences. Students were required to unscramble each anagram to make one sentence in the 60-90 second time limit. For the experimental group both the average and above average showed that their improvements in accuracy were significantly greater than their improvement in speed. There

was also a significantly greater performance in comprehension for the experimental over the control group who received no training.

Results of Weaver's study are in line with other research that indicates text organizational skills are an important component of reading comprehension and that direct training in it may enhance comprehension.

In closing, it seems apparent that the short-term memory plays a central role in the sorting and manipulating of text information during reading. The ability to recognize key propositions as major ideas and hold them over as an accumulating text premise is a key task involved in text comprehension. Perhaps, training in text organization skills may lead to a more directed use of the short-term memory buffer and thereby to an improved ability to select, rehearse and remember key text propositions. Highly developed text organization skills may, therefore, allow the reader to more efficiently link propositions based on the readers' own schemata and the developing text premise resulting in improved text comprehension overall.

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